MAMMALIAN SPECIES No. 596, pp. 1–4, 5 figs.

Peromyscus spicilegus.

By Heather R. Roberts, David J. Schmidly, and Robert D. Bradley

Published 4 December 1998 by the American Society of Mammalogists

Peromyscus spicilegus Allen, 1897

Gleaning Mouse

Peromyscus spicilegus Allen, 1897:50–51. Type locality "Mineral San Sebastián, Mascota, Jalisco, Mexico."
Peromyscus boylei spicilegus: Osgood, 1909:149.
Peromyscus spicilegus: Carleton, 1977:41.

CONTEXT AND CONTENT. Order Rodentia, Suborder Sciurognathi, Family Muridae, Subfamily Sigmodontinae, Genus *Peromyscus*, Subgenus *Peromyscus*. *Peromyscus spicilegus* is a monotypic species (Bradley et al., 1996; Carleton, 1977).

DIAGNOSIS. *Peromyscus spicilegus* (Fig. 1) is the smallest member of the *Peromyscus aztecus* species group. The crania of *P. spicilegus* (Fig. 2) typically resemble those of *P. aztecus* and *P. winkelmanni*, including the interorbital region which possesses the angular shape characteristic of the *P. aztecus* group. However, *P. spicilegus* is smaller in all cranial measurements. In addition, examination of the molar toothrow reveals a relatively complex condition with secondary primary folds prominent on m3. Perhaps the single-most diagnostic, morphological characteristic is the length of the protractile tip of the glans penis. In *P. spicilegus* ($\bar{X}$ = 2.78 mm, n = 61), it is substantially longer than in either *P. aztecus* ($\bar{X}$ = 2.10 mm, n = 129) or *P. winkelmanni* ($\bar{X}$ = 2.44 mm, n = 11; Bradley et al., 1996; Carleton, 1977). *P. spicilegus* differs from members of the *P. boylii* species group by having an angular interorbital region and a furrowed glans penis (Carleton, 1977). From *P. boylii* species group members, it differs from *P. b. rowleyi* by its bright tawny color and blackish ears; from *P. levipes* by its smaller auditory bullae; and from *P. simulus* by its larger teeth, longer nasals, and larger overall body size.

GENERAL CHARACTERS. *Peromyscus spicilegus* (Fig. 1) is medium in size for the genus; the tail is as long as the head and body, weakly bicolored, moderately well-haired, and generally well-tufted at the end; the hind feet are medium in length; and the skull is medium in length, the interorbital region is angular, and auditory bullae are small. Compared with other members of the *P. aztecus* species group, to which it is most closely related, *P. spicilegus* generally is smaller in size for cranial characters but is larger for most measurements of the glans penis and baculum. The following characters (means in mm) are based on 441 individuals from 17 populations and include both males and females considered to be adult individuals (Bradley et al., 1996): total length, 202.9; tail length, 100.0; body length, 103.0; hind foot length, 22.2; ear length, 18.4; greatest length of cranium, 28.1; length of rostrum, 11.2; length of nasals, 10.2; postpalatal length, 9.3; zygomatic breadth, 14.1; breadth of braincase, 12.7; mastoid breadth, 11.7; least interorbital width, 4.5; length of molar toothrow, 4.4; length of incisive foramen, 5.2; length of auditory bulla, 5.3; depth of braincase, 9.7; length of mesopterygoid fossa, 4.8; length of bony palate, 4.5; rostral breadth, 4.8; greatest breadth across molars, 5.5; postdental palatal breadth, 4.1; and width of mesopterygoid fossa, 2.4.

The unworn pelage has upperparts rich, tawny approaching ocherous rufous; dusky and dusky-tipped hairs uniformly distributed throughout upperparts, sometimes slightly concentrated on

FIG. 1. *Peromyscus spicilegus* from 12 km E Ojitos, Durango. Specimen not cataloged.

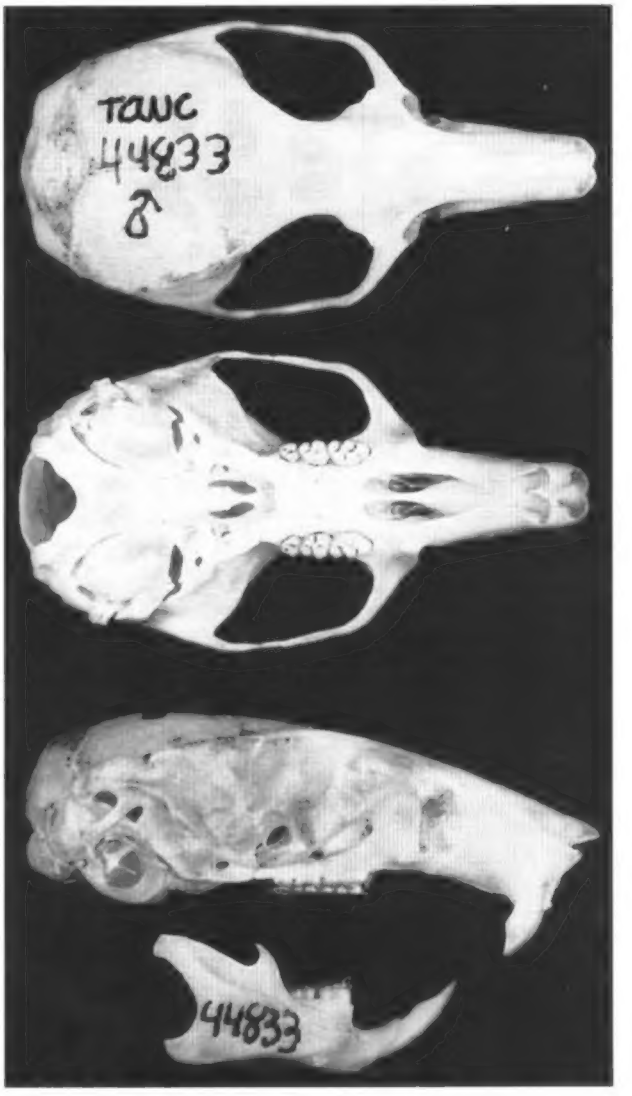

FIG. 2. Dorsal, ventral, and lateral views of skull and lateral view of mandible of *Peromyscus spicilegus* from 6.6 mi E Uruapan, Michoacán, Mexico (male, Texas A&M University, Texas Cooperative Wildlife Collection, 44833). Greatest length of skull 28.3 mm.

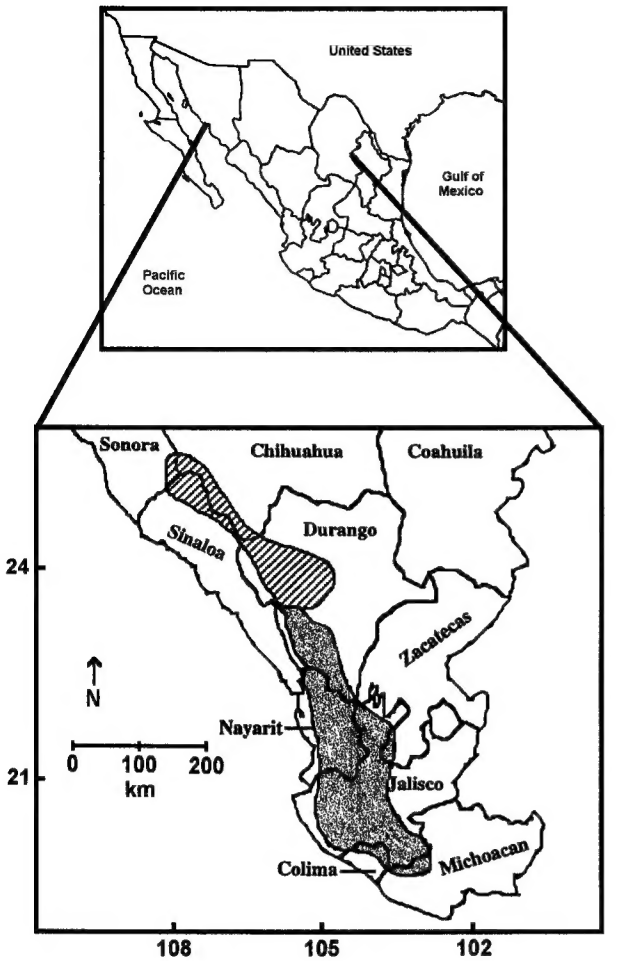

FIG. 3. Distribution of *Peromyscus spicilegus* in western Mexico. Shaded area based on distribution of historical localities (Carleton, 1989). Hatched area represents proposed extension of distribution based on recent data (Bradley et al., 1996; R. D. Bradley, in litt.).

dorsum, forming a poorly defined stripe of blackish; sides like back with a broad lateral line, but not strictly contrasted; a black or nearly black orbital ring that extends posteriorly into a grizzled area between the eye and the base of the ear; ears dusky with partially concealed black hairs at the base; white feet; hind legs dusky extending to and slightly beyond metatarsal joint; underparts usually creamy-white with a slate-gray undercolor; a large, tawny pectoral spot frequently present; and the tail is blackish-brown above, white below with coarse annulations. The worn pelage is similar to the unworn pelage with upperparts duller, more nearly ocherous buff, with dusky mixture minimized or changed to pale brownish; and the middle of back is nearly cinnamon. The adolescent pelage has underparts nearly sepia with a tinge of fawn and the lateral line is pale ocherous-buff (Allen, 1897).

Geographic and non-geographic variation recently have been examined in several populations of *P. spicilegus* (Bradley et al., 1996). Significant differences were found to exist in some external and cranial measurements among age classes (defined by Schmidly, 1972) and between sexes. For two characters (total length and breadth of braincase), individuals from age class VI (old adults) were significantly larger than those from age classes IV (subadults) and V (adults). In addition, sexual dimorphism was found to exist in the length of the mesopterygoid fossa which was significantly larger in females. These are significant observations as most members of the *P. boylii* and *P. aztecus* species groups typically display little or no sexual dimorphism or age variation. Morphological variation also has been shown between populations from lower and higher elevations. Measurements of the total body length, tail length, width of skull, and length of lower molar toothrow were

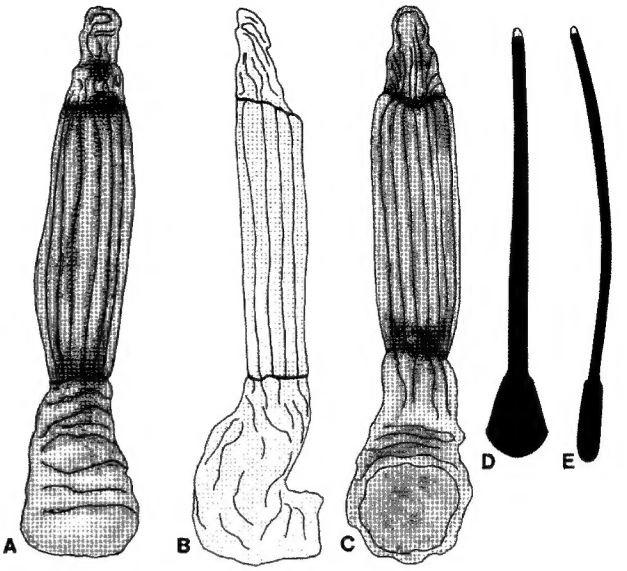

FIG. 4. Glans penis and baculum of *Peromyscus spicilegus*: A, dorsal view of glans penis; B, lateral view of glans penis; C, ventral view of glans penis; D, ventral view of baculum; E, lateral view of baculum (Bradley and Schmidly, 1987).

found to be significantly different between populations of *P. spicilegus* in Jalisco, with those at higher elevations exhibiting larger measurements (Sánchez-Cordero and Villa-Ramírez, 1988). At higher elevations, total body length averages ranged from 190.7 to 197.7 mm versus 187.9 mm at lower elevations; tail length averages ranged from 96.7 to 99.0 mm at high versus 84.6 mm at low; average width of skull ranged from 12.7 to 21.7 mm at high versus 12.4 mm at low; and length of molar toothrow averages ranged from 4.3 to 4.4 mm at high versus 4.2 mm at low elevations. However, these differences were not substantial enough to warrant separation of populations into separate subspecies.

DISTRIBUTION. *Peromyscus spicilegus* occurs in western Mexico (Fig. 3) in southern Sinaloa and Durango, Nayarit, Colima, western Jalisco, and northern Michoacán (Bradley et al., 1996; Carleton, 1977, 1989). Specimens from northern Sinaloa and southern Sonora have been referred to as possibly being representative of *P. spicilegus* (Bradley et al., 1996). In addition, specimens of *P. spicilegus* have been collected from central and west-central Durango (R. D. Bradley, in litt.). Throughout this region it occurs at a variety of elevations, ranging from 15 to 1,980 m, and habitats including coastal lowlands to montane regions along the western slopes of the Sierra Madre Occidental. There is no fossil record for this species.

FORM AND FUNCTION. The glans penis (Fig. 4) is intermediate in length (8.46–9.36 mm) and vase-shaped, longitudinally furrowed or fluted, lacking dorsal and ventral lappets, ca. 0.4 times length of hind foot, and ca. 4.6 times longer than wide. The dorsal and ventral surfaces are covered with dense triangular-shaped spines, with spines on the dorsal surface smaller than those on the venter. The protractile tip is longer than those in other taxa classified in the *P. boylii* and *aztecus* groups. The baculum is rod-shaped (Fig. 4), medium in length (1.3 times longer than the glans penis; 11.32–12.66 mm), curved laterally, and the base is triangular and four times wider than the shaft; the cartilaginous tip is minute (Bradley et al., 1990; Carleton, 1977).

The following mean dimensions of the penis (in mm) are based on 30 individuals from one population (Bradley and Schmidly, 1987): length of distal tract, 12.73; length of glans, 8.57; length of protractile tip, 2.63; greatest width of glans, 1.89; length of baculum, 11.13; length of cartilaginous tip, 0.16; width of baculum at base, 1.42; and greatest width of baculum, 0.34. *P. spicilegus* possesses the following character states for seven qualitative penile characters: very dense dorsal spines, very dense ventral spines, very small dorsal spines, extra small ventral spines, poorly-developed dorsal lappets, poorly-developed ventral lappets, and strongly-developed furrowing (Bradley and Schmidly, 1987).

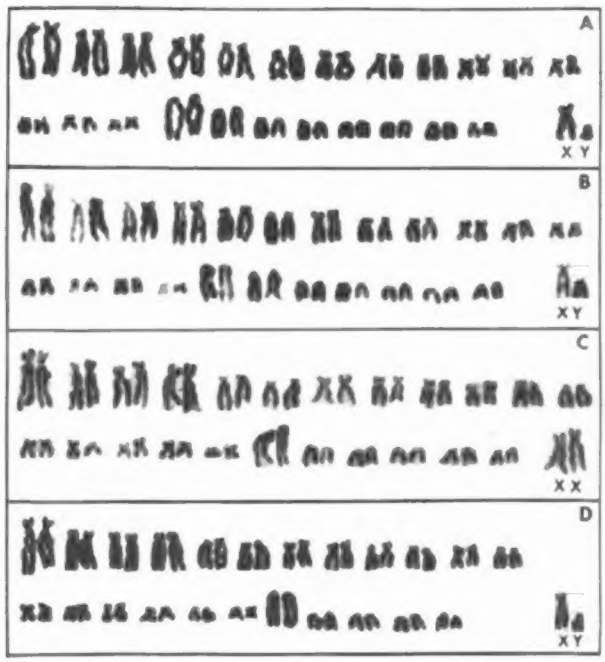

FIG. 5. Representative karyotypes of *Peromyscus spicilegus* from Michoacan and Jalisco depicting geographic polymorphisms: A, FN = 76; B, FN = 78; C, FN = 80; D, FN = 82 (Smith et al., 1989).

ECOLOGY. *Peromyscus spicilegus* is unusual compared with other members of the *P. boylii* and *P. aztecus* groups in that it occupies both the humid tropical lowlands and montane regions. Typically, members of these species groups are found in one or the other of these two habitat types rather than both. Osgood (1904:65) stated "*P. spicilegus* is essentially a mountain animal, and is not usually found except at considerable elevations." In Nayarit, at lower and middle elevations it is found along arid, rocky hillsides, and at higher elevations it occurs in pine-oak forest (Carleton et al., 1982). In Durango, *P. spicilegus* occupies areas from the tropical, deciduous forests of the western slopes of the Sierra Madre Occidental to the thorn forest of the Pacific lowlands (Baker and Greer, 1962). In Jalisco, Hooper (1955) reported *P. spicilegus* from three localities characterized by rocks and cutbanks covered with deciduous oak and pine in canyon bottoms (San Andrés); live oak woods, brush, and grass in a boulder-strewn canyon bordered by rock cliffs (Magdalena); and moss-covered roots, logs, and rocks in a cool moist canyon (Autlán).

ONTOGENY AND REPRODUCTION. In Nayarit, Mexico, males with scrotal testes were caught in January, March, September, and October. Lactating females were caught in January, September, and October. Juveniles were caught in February and March. Nonreproductive animals were trapped in the same months as well as in November (Carleton et al., 1982).

GENETICS. The karyotype for *P. spicilegus* (Fig. 5) is 2n = 48 and FN = 79–84 for specimens from Nayarit, Mexico (Carleton et al., 1982) and 76–82 for individuals from Michoacán and Jalisco (Smith et al., 1989). To date, this range of FN (76–84) is the highest reported for members of the *P. aztecus* species group. In a cladistic analysis of G-banded chromosomes, *P. spicilegus* clustered with members of the *P. maniculatus* species group (*P. maniculatus* and *P. sitkensis*) rather than to other members of the *P. aztecus* group (Smith, 1990). The X chromosome is a large submetacentric and the Y chromosome is a medium-sized metacentric (Schmidly and Schroeter, 1974).

An allozyme study of the *P. boylii* assemblage (Sullivan and Kilpatrick, 1991) found the average genetic identity (Nei, 1972) was 0.905 between *P. aztecus* and *P. spicilegus* and 0.814 between *P. spicilegus* and *P. winkelmanni*. Additionally, a fixed allelic difference was identified at the dipeptidase (Pep-D) locus between two populations of *spicilegus* from Nayarit and Michoacán. In a comprehensive allozyme study of 16 species of *Peromyscus*, it was determined that *P. spicilegus* was related most closely to *P. hylocetes* (Sullivan et al., 1991), contradicting the findings of Smith (1990), but supporting the conclusions of Sullivan and Kilpatrick (1991). In addition, *P. spicilegus* has been found to be autapomorphic for the LDH-2^{460} allele (Sullivan et al., 1991).

REMARKS. The taxonomy and classification of *P. spicilegus* has been rather controversial. It was initially described by Allen (1897) as a distinct species. Later, it was reduced to subspecific status under *P. boylei* by Osgood (1909). This arrangement resulted in possible combinations of five subspecies of *P. boylii* (*evides, levipes, rowleyi, simulus,* and *spicilegus*) occurring sympatrically at several localities in western Mexico. Subsequent studies (Baker and Greer, 1962; Carleton, 1977, 1979; Carleton et al., 1982; Hooper, 1955; Schmidly and Schroeter, 1974) eventually identified morphological, karyotypic, and ecological characteristics which, along with the observation of sympatric coexistence of various combinations of these subspecies, resulted in the elevation of *P. b. spicilegus* to species status. The specific name, *spicilegus*, is apparantly from the Latin, *spica*, meaning a spike, tuft, or ear of grain, and *lego* meaning to collect, thus describing a mouse that gleans grain (Jaeger, 1955.)

Substantial levels of morphological variation exist among populations of *P. spicilegus*, although no geographic subdivisions are correlated with these morphological patterns (Bradley et al., 1996). There is speculation that the samples of *P. spicilegus* examined by Sullivan and Kilpatrick (1991) may represent more than one taxon. Bradley et al. (1996) determined that previously unexamined specimens from southern Sonora and northern Sinaloa morphologically appeared to be typical of *P. spicilegus*. If this association with *P. spicilegus* is correct then the range of *P. spicilegus* should be extended northward ca. 450 km (Bradley et al., 1996).

We thank F. D. Yancey II for assistance in generating photographs of the skull and mandible, and G. Baumgardner (Texas Cooperative Wildlife Collection) for the loan of specimens. Special thanks to S. A. Smith and the American Society of Mammalogists, Journal of Mammalogy, for permission to reproduce the figure depicting the karyotype.

LITERATURE CITED

ALLEN, J. A. 1897. Further notes on mammals collected in Mexico by Dr. Audley C. Buller, with descriptions of new species. Bulletin of the American Museum of Natural History, 9:47–58.

BAKER, R. H., AND J. K. GREER. 1962. Mammals of the Mexican state of Durango. Publications of the Museum, Michigan State University, Biological Series, 2:25–154.

BRADLEY, R. D., AND D. J. SCHMIDLY. 1987. The glans penes and bacula in Latin American taxa of the *Peromyscus boylii* species group. Journal of Mammalogy, 68:595–616.

BRADLEY, R. D., R. D. OWEN, AND D. J. SCHMIDLY. 1996. Morphological variation in Peromyscus spicilegus. Occasional Papers, The Museum, Texas Tech University, 161:1–23.

BRADLEY, R. D., D. J. SCHMIDLY, AND R. D. OWEN. 1990. Variation in the glans penes and bacula among Latin American populations of Peromyscus aztecus. Occasional Papers, The Museum, Texas Tech University, 135:1–15.

CARLETON, M. D. 1977. Interrelationships of populations of the *Peromyscus boylii* species group (Rodentia, Muridae) in western Mexico. Occasional Papers of the Museum of Zoology, University of Michigan, 675:1–47.

———. 1979. Taxonomic status and relationships of *Peromyscus boylii* from El Salvador. Journal of Mammalogy, 60:280–296.

———. 1989. Systematics and evolution. Pp. 7–141, *in* Advances in the study of *Peromyscus* (Rodentia) (G. L. Kirkland, Jr., and J. N. Layne, eds.). Texas Tech University Press, Lubbock, 366 pp.

CARLETON, M. D., D. E. WILSON, A. L. GARDNER, AND M. A. BOGAN. 1982. Distribution and systematics of *Peromyscus* (Mammalia: Rodentia) from Nayarit, Mexico. Smithsonian Contributions in Zoology, 352:1–46.

HOOPER, E. T. 1955. Notes on mammals of western Mexico. Occasional Papers of the Museum of Zoology, University of Michigan, 565:1–26.

JAEGER, E. C. 1955. A source-book of biological names and terms. Third ed. Charles C Thomas, Publisher. Springfield, Illinois, 317 pp.

NEI, M. 1972. Genetic distance between populations. The American Naturalist, 106:283–292.

OSGOOD, W. H. 1904. Thirty new mice of the genus *Peromyscus* from Mexico and Guatemala. Proceedings of the Biological Society of Washington, 17:55–77.

———. 1909. Revision of the mice of the American genus *Peromyscus*. North American Fauna, 28:1–285.

SÁNCHEZ-CORDERO, V., AND B. VILLA-RAMÍREZ. 1988. Variación morfométrica en *Peromyscus spicilegus* (Rodentia: Cricetidae) en la parte noreste de Jalisco, México. Instituto de Biología, Universidad Nacional Autónoma de México, Serie Zoología, 2: 819–836.

SCHMIDLY, D. J. 1972. Geographic variation in the white-ankled mouse, *Peromyscus pectoralis*. The Southwestern Naturalist, 17:113–138.

SCHMIDLY, D. J., AND G. L. SCHROETER. 1974. Karyotypic variation in *Peromyscus boylii* (Rodentia: Cricetidae) from Mexico and corresponding taxonomic implications. Systematic Zoology, 23:333–342.

SMITH, S. A. 1990. Cytosystematic evidence against monophyly of the *Peromyscus boylii* species group (Rodentia: Cricetidae). Journal of Mammalogy, 71:654–667.

SMITH, S. A., I. F. GREENBAUM, D. J. SCHMIDLY, K. M. DAVIS, AND T. W. HOUSEAL. 1989. Additional notes on karyotypic variation in the *Peromyscus boylii* species group. Journal of Mammalogy, 70:603–608.

SULLIVAN, J. M., AND C. W. KILPATRICK. 1991. Biochemical systematics of the *Peromyscus aztecus* assemblage. Journal of Mammalogy, 72:681–696.

SULLIVAN, J. M., C. W. KILPATRICK, AND P. D. RENNERT. 1991. Biochemical systematics of the *Peromyscus boylii* species group. Journal of Mammalogy, 72:669–680.

Editor of this account was LESLIE N. CARRAWAY. Managing editor was BARBARA H. BLAKE.

HEATHER R. ROBERTS, DAVID J. SCHMIDLY, AND ROBERT D. BRADLEY, DEPARTMENT OF BIOLOGICAL SCIENCES, TEXAS TECH UNIVERSITY, LUBBOCK, TEXAS 79409-3131.